SYSTEM AND METHOD OF COMPILING AND ORGANIZING POWER CONSUMPTION DATA AND CONVERTING SUCH DATA INTO ONE OR MORE USER ACTIONABLE FORMATS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. application Ser. No. 14/372,056, filed Jul. 14, 2014, which is the National Stage of International Application No. PCT/CA2013/000062, filed Jan. 21, 2013, which in turn claims the benefit of U.S. Provisional Application No. 61/589,203, filed on Jan. 20, 2012, all of which are herein incorporated by reference in their entirety.

FIELD OF THE INVENTION

[0002] The present invention relates to the field of granular power monitoring, data analytics and enhanced data use at both the consumer and industry levels.

BACKGROUND OF THE INVENTION

[0003] Energy management is a term that generally relates to or is implemented by systems, processes and devices in order to reduce energy consumption and understand energy consumption patterns. This can occur in private homes, in businesses, in factories/manufacturing facilities and in public-sector/government organizations, to name a few.

[0004] From the perspective of an energy consumer, the process of monitoring, controlling, and conserving energy in a building or organization typically involves the following steps, with noted challenges and limitations:

[0005] 1. Metering (in some fashion) energy consumption and collecting the data.

[0006] 2. Understanding the raw data and/or collecting data that is useful.

[0007] 3. Finding opportunities to save energy, and estimating how much energy each opportunity could save. For example, an individual could analyze her meter data to find and quantify routine energy waste, and might also investigate the energy savings that could be made by replacing equipment (e.g. lighting) or by upgrading a building's insulation.

[0008] 4. Taking action to target the opportunities to save energy (i.e. addressing the routine waste and replacing or upgrading inefficient equipment).

[0009] 5. Tracking progress by analyzing meter data to see how well the energy-saving efforts have worked.

[0010] At a consumer level, as the cost of energy/electricity continues to increase, there is greater awareness of consumption issues and more thought put into sustainable energy planning. For example, people are buying more high fuel efficiency cars including both smaller and hybrid electric cars.

[0011] However, in order for people to use less energy/electricity in their homes and businesses, they need to have some means to assess energy usage and to make appropriate adaptations and decisions. One approach in energy-data collection is to manually read meters once a week or once a month. This is not only onerous but of very limited use in terms of data spread.

[0012] An alternative approach to energy-data collection is to install interval-metering systems that automatically measure and record energy consumption at short, regular intervals such as every hour, every 15-minutes, or even every few seconds when needed. This detailed interval energy consumption data makes it possible to see patterns of energy waste that it would be impossible to see otherwise: for example one can ascertain how much energy is being used at different times of the day or on different days of the week. Using the detailed interval data, it is possible to make broad brush estimates of how much energy is being wasted at different times. For example, if a person identifies that energy is being wasted by electronics left on over the weekends, one can:

[0013] a. Use interval data to calculate how much energy (in kWh) is being used each weekend.

[0014] b. Estimate the proportion of that energy that is being wasted (by electronics that should be switched off).

[0015] c. Using the figures from a and b, calculate an estimate of the total kWh that are wasted each weekend.

[0016] i. This type of data and information is in bulk "aggregate" form and is not particular or granular.

[0017] Using power sensors on every device, it is possible to acquire an itemized bill that shows usage and energy cost for various appliances. With itemized data, consumers can take action to conserve, by either installing more energy efficient appliances (air conditioners, clothes washers/dryers, hot tubs, ovens, lighting, etc. . . .), or changing their usage patterns in areas where pricing of energy/electricity varies by time of day, or simply turning loads off when not in use. The problem is that people do not want to incur the significant expense required to install power sensors on each of their appliances and electric loads. This underscores the significant problems:

a) while there is some value to the bulk aggregate data, it is not the definitive picture in energy management, in fact, it barely scratches the surface of what should be possible and available to power consumers; and

b) load disaggregation or cataloguing power usage at a granular level is difficult to currently achieve. Even if power sensors are attached onto every single appliance in a home, there is still the issue of the value of the produced raw data without further enhancements and value added.

[0018] From the perspective of the consumer, as opposed to utility companies, there are some overlapping but also different concerns in regards to power usage. With the advent of "smart grid" technologies, also called "smart home", "smart meter", or "home area network" (HAN) technologies, optimized demand reductions became possible at the end use or appliance level. Some smart grid technologies provided the ability to capture real-time or near-real-time end-use data and enabled two-way communication. Smart grid technologies currently exist for at least some percentage of a utility's customer base and applications are growing throughout North America. From a consumer perspective, smart metering offers a number of potential benefits to householders. These include the provision of a tool to help consumers better manage their energy use. Smart meters with a display can provide up to date information on gas and electricity consumption in the currency of that country and in doing so help people to better manage their energy use and reduce their energy bills and carbon emissions.

[0019] Various "load disaggregation" (as defined below) algorithms have been suggested in the literature. One technique of decomposing the power signal measured at the